BEARCAT PUMPS

www.bearcatpumps.com

Service Manual
600R, 600V and 600B Pump

600R Rubber Pump

600V Virgin Pump

600B Crude Oil Pump

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GENERAL SAFETY PRECAUTIONS

- This manual should be read entirely prior to the commencement of installation and operation.
- Only qualified personnel should install, operate and maintain this pump and associated equipment.
- Check pump for specific safety warnings/labels.
- Prior to start-up, ensure complete cleanliness and integrity of the system in which the pump is installed.
- In most cases the relief valve is factory set during performance test. In cases where the type of duty is not known (such as distributors or stock orders) or where the components containing the relief valve come from pre-tested stock batches, it is not possible to factory set the relief valve. In this case it is the installers responsibility to set the relief valve in accordance with the specific application.
- Pumps with heat tracing or jacketing necessary to prevent solidification of the product should be brought up to working temperature prior to start-up.
- All electrical work must be done in accordance with the manufacturers recommended procedures by qualified personnel.
- Ensure all guards are securely in place before operating the equipment. Do not remove guards at any time during operation.
- For pumps operating under 'flooded' suction, when venting the pump through a plug or valve, care should be taken not to completely remove vent plugs or completely open any vent as this could result in liquid being discharged from the openings under pressure.
- Prior to start-up, ensure that the system valves and associated equipment are correctly set.
- Wear appropriate safety attire including long sleeves, face shield, and gloves, whenever starting or operating the pump.

OVERVIEW

The BearCat 600 is an external gear, positive displacement pump designed specifically for pumping asphalt. It is entirely heat jacketed with relief valve in both flow directions.

Three different models are available:

600V: Bronze bushing and shaft design. Works well for standard asphalt and emulsions.

600R: AR Spherical Bearing design, rebuildable pump. Ruggedized model designed for Asphalt/ Rubber.

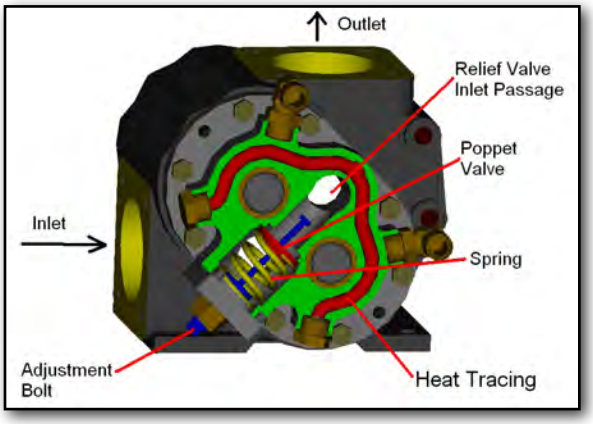
Applications include: the primary pump of an Asphalt Distributor, Plant supply through a Micro Motion® Coriolis (Mass Flow) meter, Blend transfer, or as an unloading pump.

600B: Bronze bushings, nitride shafts, hardened steel gears, works well with all grades of crude oil, condensate, produced water, brine, iron sulfate and mixed byproducts.

Applications include: loading and unloading of crude oil transport trucks and trailers, fluid transfer for tank battery, LACT units and refineries.

Relief Valve

One of the prominent features of the BearCat pump is its endplate/relief valve design. The modularity of the plate provides mounting on both ends of the pump, and thus pressure relief in both directions. Because the forward flow is controlled by one end, and the reverse flow by the other, each can be adjusted independently. The heat tracing offers a critically important benefit to start-up. Its balance of heat in relation with that of the main body insure full function of the relief valve prior to pump rotation when full of asphalt.



No-Leak Lip Seal

The standard 600 comes with a high temperature, no-leak, low maintenance seal design. Supported internally by a roller bearing, the drive shaft runs precise, thus prolonging seal life.

Packed Seal available upon request. Graphite impregnated split ring packing can be specified if needed.

INSTALLATION

Shaft Alignment

In the case of a belt driven system, care should be taken to insure proper alignment and tension of the drive belts and pulleys. A pillow block must be used in order to support the side load from the belts. Insure that the belts and pulleys are free and clean from oil and debris.

In the case of a direct drive system, proper care must be used to insure that the coupled shafts are accurately aligned. Failure to do so may result in rapid wear of the seal and/or reduced pump life.

System Piping

Pump should be positioned as near as possible to source feeding it. Suction piping must be no smaller in diameter than the pump intake port and designed to avoid sharp bends, changes in sections or undue restrictions. Pressure drops due to an accumulation of valves, flex lines, etc can be considerable and must be taken into consideration.

Certain designs such as a low level drop are designed in order to maintain a minimum amount of liquid at the pump. After evacuating the lines, this remaining liquid can significantly improve start-up priming.

Piping Strain

To ensure undue forces are not present, flange bolts (suction and discharge) should be completely slackened. If flanges are observed to spring apart, twist or move out of parallel excessively, remedial action must be taken.

The piping system can expand and contract considerably with the changes in temperature. Ensure that the final system allows for this change.

RELIEF VALVE

Each endplate can relieve the pressure in one flow direction only. As such, if the valves are set in opposing directions, each direction is independently adjustable. So it is possible to pressure relieve at 80 PSI in one direction, while 30 PSI in reverse. It is important for the operator to understand which valve controls each flow direction.

Caution:

A relief valve is necessary to protect the pump and system from potentially dangerous over-pressure.

The relief valve will operate in the event of a restriction in the discharge line or the inadvertent closure of a downstream valve.

The valve must not be used as a flow control device.

If the pump is supplied without an internal relief valve, a suitable external relief to the system must be supplied

The internal relief valve will have been factory set. However, check for correct operation upon installation.

Re-adjustment may be necessary due to viscosity variations.

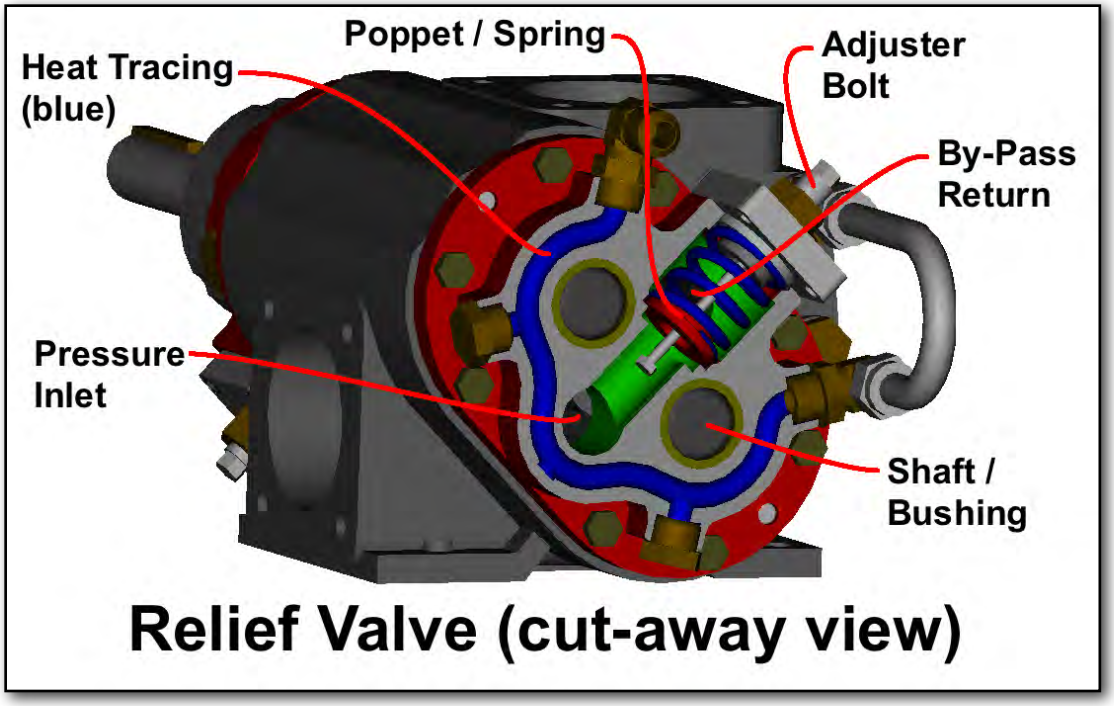
Relief Valve Setting

V & R Series

The standard factory setting for the forward flow in the pump is 80 psi. This is done by setting the flat where the hex meets up with the threads of the adjuster bolt flush with the edge of the lock nut. Backing the bolt out from this setting will lower the pressure. Tightening it will increase pressure at which the valve will open.

B Series

The standard setting for the 600B (Crude Oil) pump is 60 psi (four threads above the nut).



Relief Valve (cut-away view)

START-UP

Caution:

Be sure all guards are in place, and all appropriate safety gear is worn prior to starting pump.

During initial run, pump speed should be operated at minimum in order to insure all functions are normal, connections are leak free, and rotation is smooth.

Cautiously increase to normal operating speed.

1. Pump should turn freely by hand. Ensure all guards are in place.

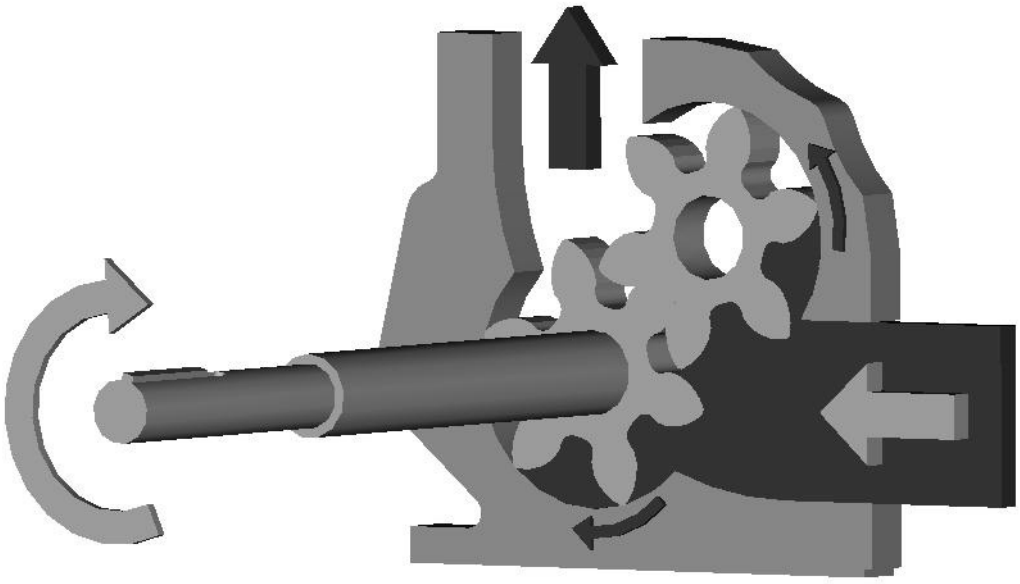
2. If heating is necessary, turn on supply and allow pump temperature to stabilize.

3. Gradually open appropriate valves, and check for signs of leakage.

4. If pump is above the level of liquid in the tank (suction lift), prime the pump by pouring a few gallons of liquid (Do not use water) in the strainer housing or adjacent piping – particularly on the suction side.

5. Check the pump rotation by flicking motor starter 'on' then 'off'. (Correct rotation indicated by diagram on pump cover plate)

6. Start pump – check system for leaks



Rotation and Flow

(Flow is reversible from what is shown)

ROUTINE MAINTENANCE

Bearing grease for 'R' series pumps

For optimal service life in an R model pump, the bearings need one of two things prior to start-up each day. Heat or Grease. Cold Asphalt Rubber (AR) is extremely tough on the bearings and castle nut assembly inside the pump. If the pump is traced with heat transfer oil, then the bearing areas will receive adequate heat that will soften the AR. However, if the pump is not traced the bearings must be greased at the end of the day just after shut-down, but while the pump is still hot. Grease with high temperature (Mystik JT-6). This will aide in lubricating the bearings and displacing/ diluting the AR prior to the next start-up.

Shaft Seal

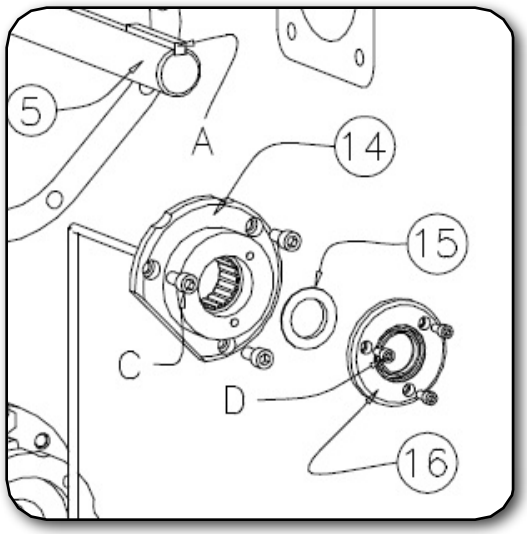
After a period of time (based on pressure, operating procedures, material, etc) it will be necessary to change the shaft seal. This is a fairly easy procedure. If the pump is leaking more than a drop a minute, or any amount deemed unacceptable, insure the the a seal kit is on hand and follow the seal replacement procedure;

Seal Replacement Procedure

1. Turn pump off completely.

2. Ensure that pump is isolated from system by closing suction and discharge valves.

3. Remove any guards, couplings, bearings, or companion flanges aft the dust seal (item 16). Remove the dust seal bracket (item 16) and use a flat head screw driver to pry out the old seal (item 15).



4. Clean the shaft surface and seal bore of any asphalt / debris. Inspect and remove any sharp burrs in the keyway and shaft body. Also inspect for groove worn into shaft by the old seal. An excessively deep groove will require shaft replacement.

5. Clear plastic tape can be used to mask keyway prior to seal installation. Once the keyway is taped, lubricate with grease. Gently slide main seal (item 15) over shaft, and into seal bore. Install new dust seal bracket.

6. Replace guards, couplings etc.

TROUBLESHOOTING

Under each fault symptom given below is a list of recommended inspections that could indicate the cause, most are elementary but are often overlooked.

The best aid to fault finding in the pump is a vacuum gauge as close as possible to the pump inlet. This can readily indicate whether the imposed suction is within the pumps capability, or if there has been a dramatic change from the conditions, which will indicate a change in the viscosity of the pumping media, resulting in higher pressure loss in the suction line, or that a filter requires cleaning, etc.

No liquid delivered or the pump will not prime.

- Check Direction of shaft rotation.
- Are suction line joints leaking in air?
- Total suction condition, is there sufficient N.P.S.H. available?
- Has the pump been properly primed before start-up?
- Is suction port blocked? Is filter clean?
- All valves in system are open?
- Is the discharge line vented? Pressure build-up will ultimately prevent suction vacuum!
- If the vacuum gauge is reading over 20inHG there is almost certainly a blockage in the suction.
- Is the material hot enough? EVERYWHERE?
- If you have a screen box, add 3 gallons of suitable liquid to help establish prime.

Pump noisy when operating

- A low growling sound is normal for new pump. The noise is attributed to the meshing of the hardened gears. The pump will tend to be louder when turning empty and will quiet down once liquid prime is established.
- A loud clacking can be an indication that the pump is cavitating. Look for signs of inlet flow restrictions or lower than normal material temperature. As a last resort, slow pump speed until noise goes away.
- Pump internals are worn.
- Debris in material. Add screen box.
- Misalignment of drive system.

TECHNICAL DATA

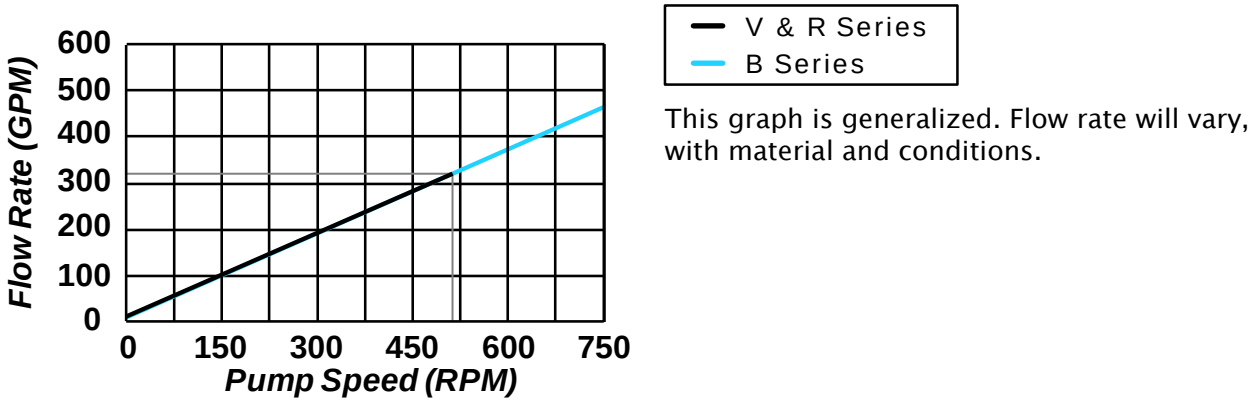
Maximum Operating Limitations

- Pressure: 130 PSI (9 BAR)
- Speed: 500 RPM
- Temperature: 500°F (260°C)

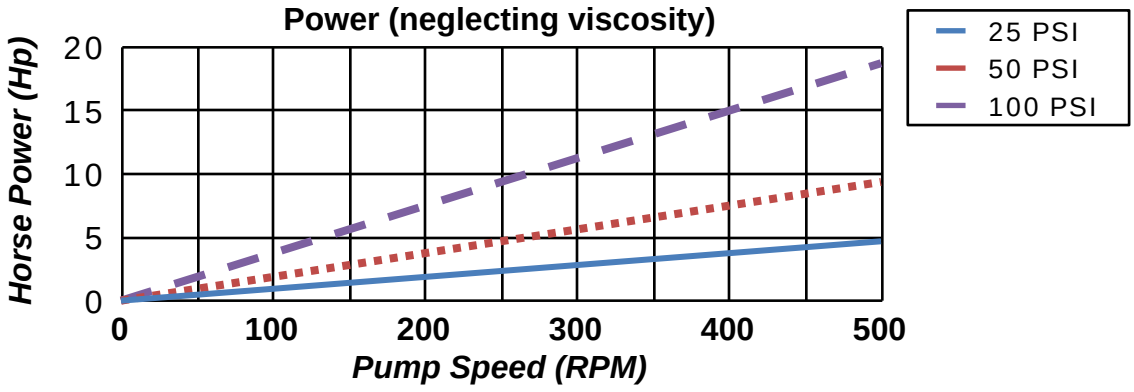
Actual flow can be limited by any number of parameters. Line flow restrictions, viscosity, material type etc. The standard maximum RPM is based on ideal conditions. As a general rule, we recommend reducing speed RPM limits by 25% when handling viscous materials such as rubberized asphalt.

When certain conditions are met, the pumps may be used in excess of the limitations. Please consult factory for high performance parameters exceeding standard specifications.

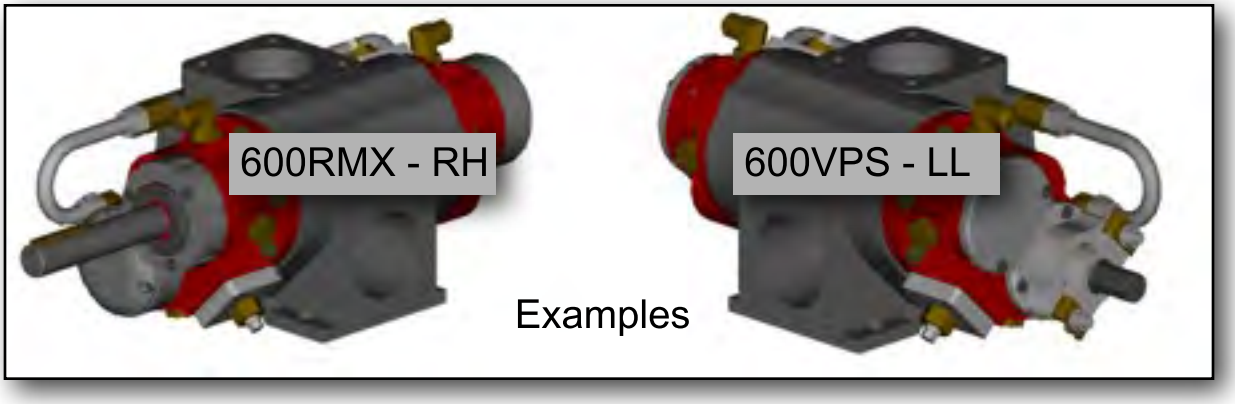
Pump Graphs



This graph is generalized. Flow rate will vary, with material and conditions.



MODEL NUMBER AND CONFIGURATION



Example: 600RMX-RH

600 - R - M - X - RH

Shaft Position
H = High Drive, **L** = Low Drive

Port Configuration
R = Right, **L** = Left

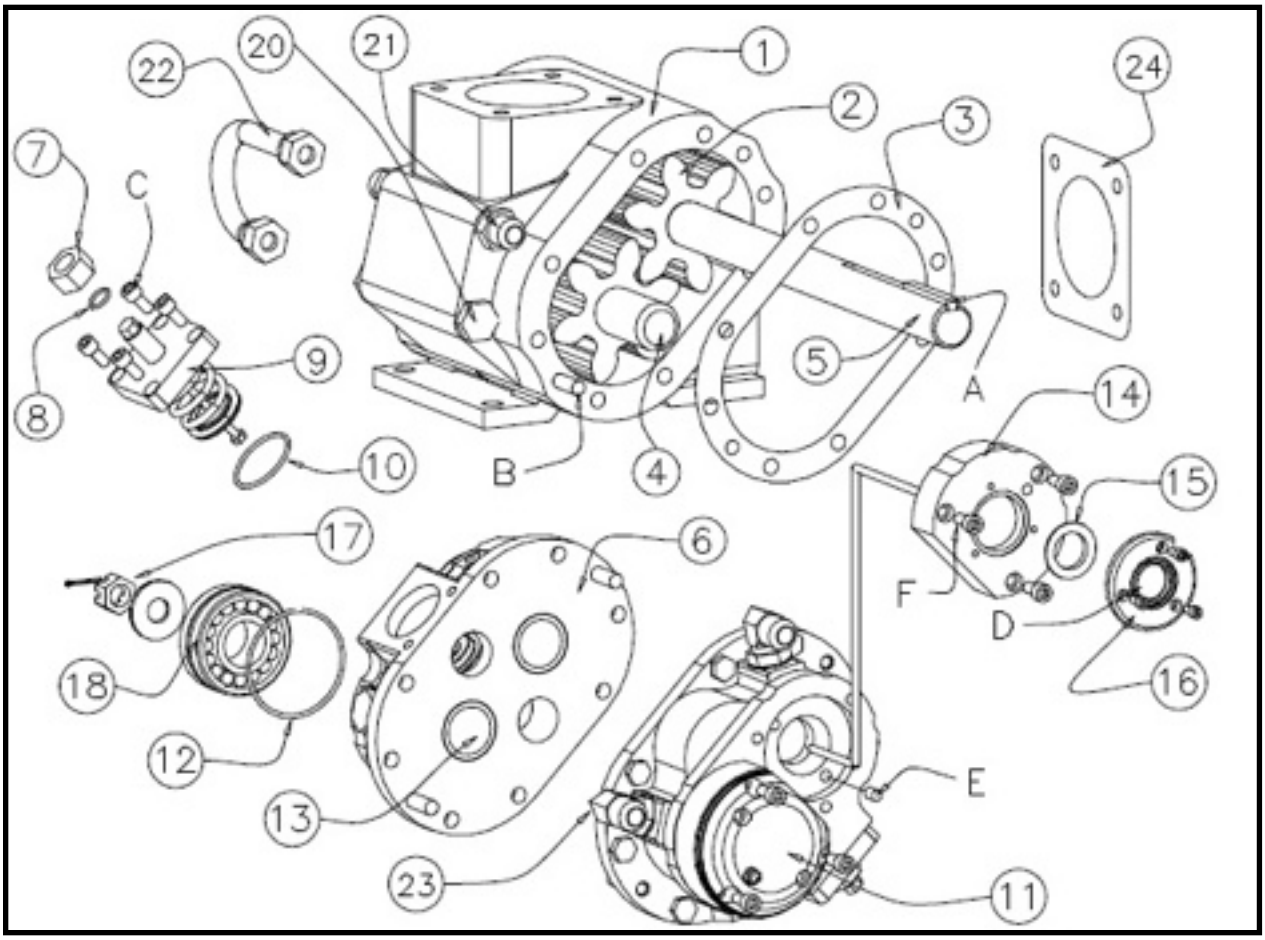
Shaft Length
S = Short, **X** = Extended

Shaft Seal
M = Modified Lip, **P** = Packed

Bearing Type
R = Rubberized Asphalt, spherical bearing
V = Virgin Asphalt, bronze bushing
B = Crude Oil, bronze bushing

Displacement
300 = 0.30 Gallon/Rev
450 = 0.45 Gallon/Rev
600 = 0.60 Gallon/Rev

600R PARTS DIAGRAM / DIMENSIONAL DRAWING



To order specify model number (ex - 600RMX) followed by item;

- (1) Housing
- (2) Gear Set
- (3) End Plate Gasket
- (4) Idler Shaft
- (5) Drive Shaft
- (6) End Plate
- (7) Adjuster Nut
- (8) Adjuster Nut O-ring
- (9) Relief Valve Assembly
- (10) O-ring RV plate
- (11) Bearing Cap
- (12) O-ring Cover Plate
- (13) Steel Sleeve

Continued

- (17) Castle Nut and Cotter Pin
- (18) Bearing

Modified Lip Seal

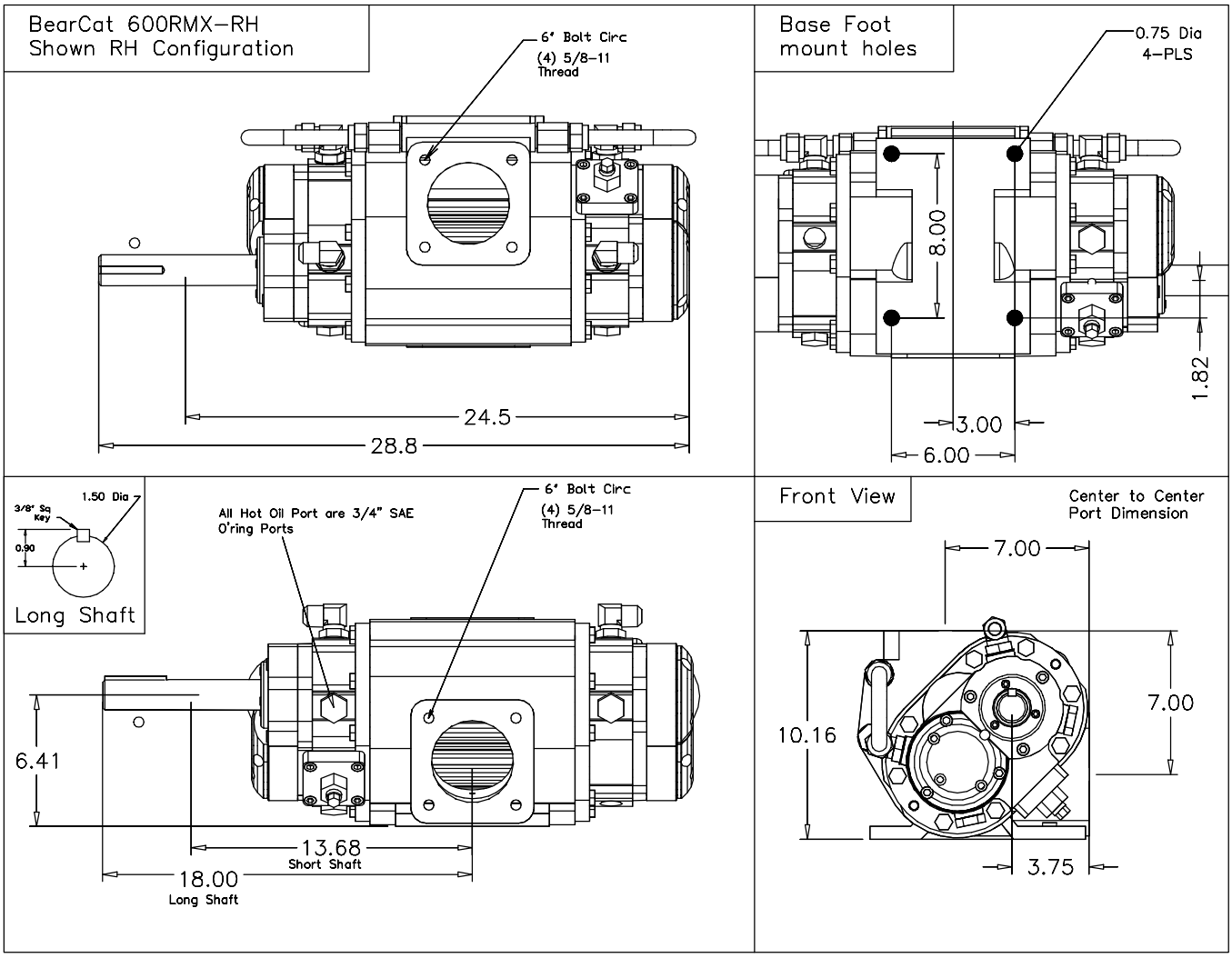
- (14) Seal Housing
- (15) Shaft Seal
- (16) Dust Seal/Mount Bracket

Heat fittings. All tapped ports require a #12 O-ring Fitting. DO NOT USE PIPE THREAD FITTINGS!

- (20) #12 MB O-ring Plug
- (21) #12 MB O-ring Straight
- (22) J-tube
- (23) #12 MB O-ring Elbow

Hardware items can be obtained from a local hardware store.

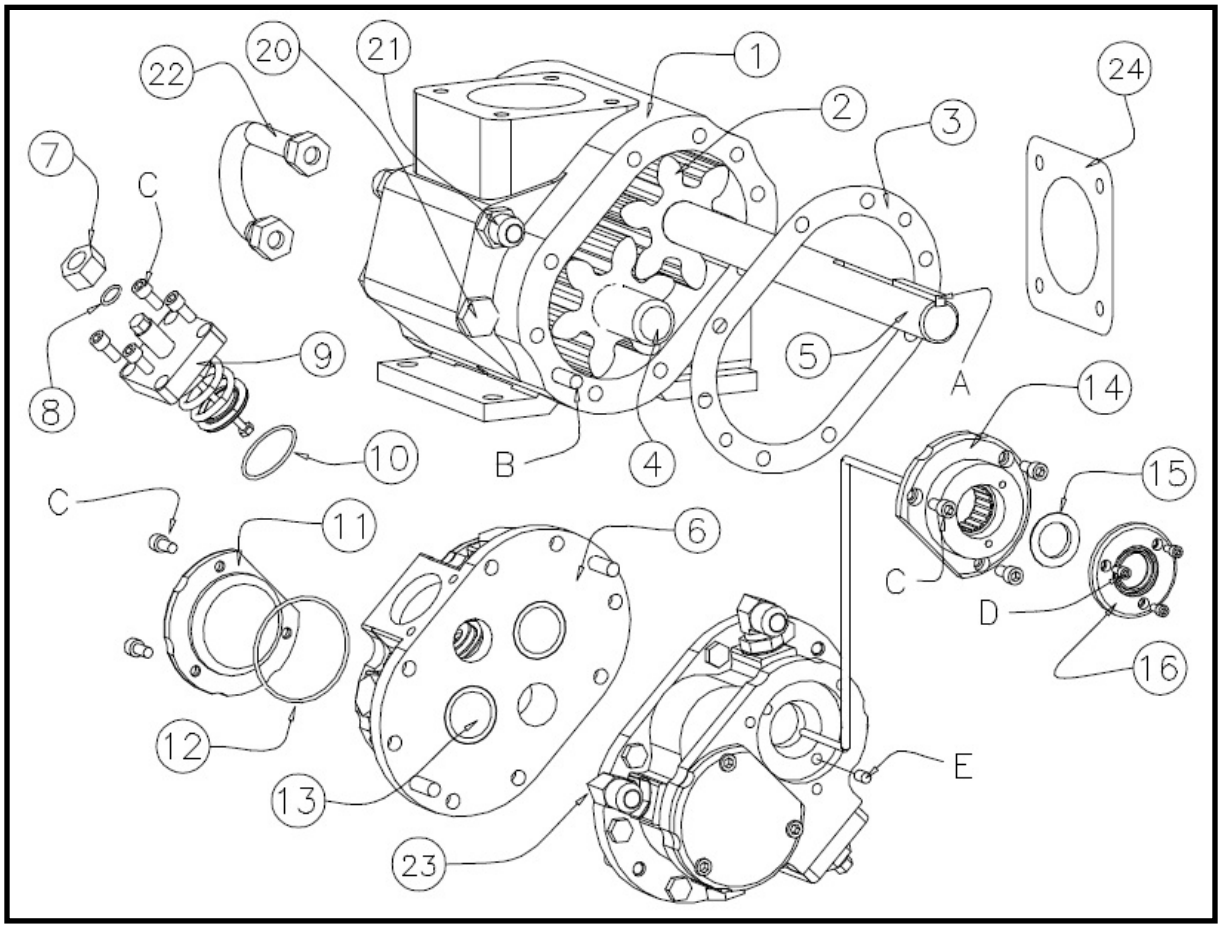
- (A) 3/8 Key stock 2” Lg
- (B) 1/2 Dowel pin 1-1/4” Lg
- (C) 3/8-16x3/4 Socket Head
- (D) 1/4-20x3/8 Socket Head
- (E) 3/8-16x1/2 Set Screw
- (F) 3/8-16x1-1/2 Socket Head



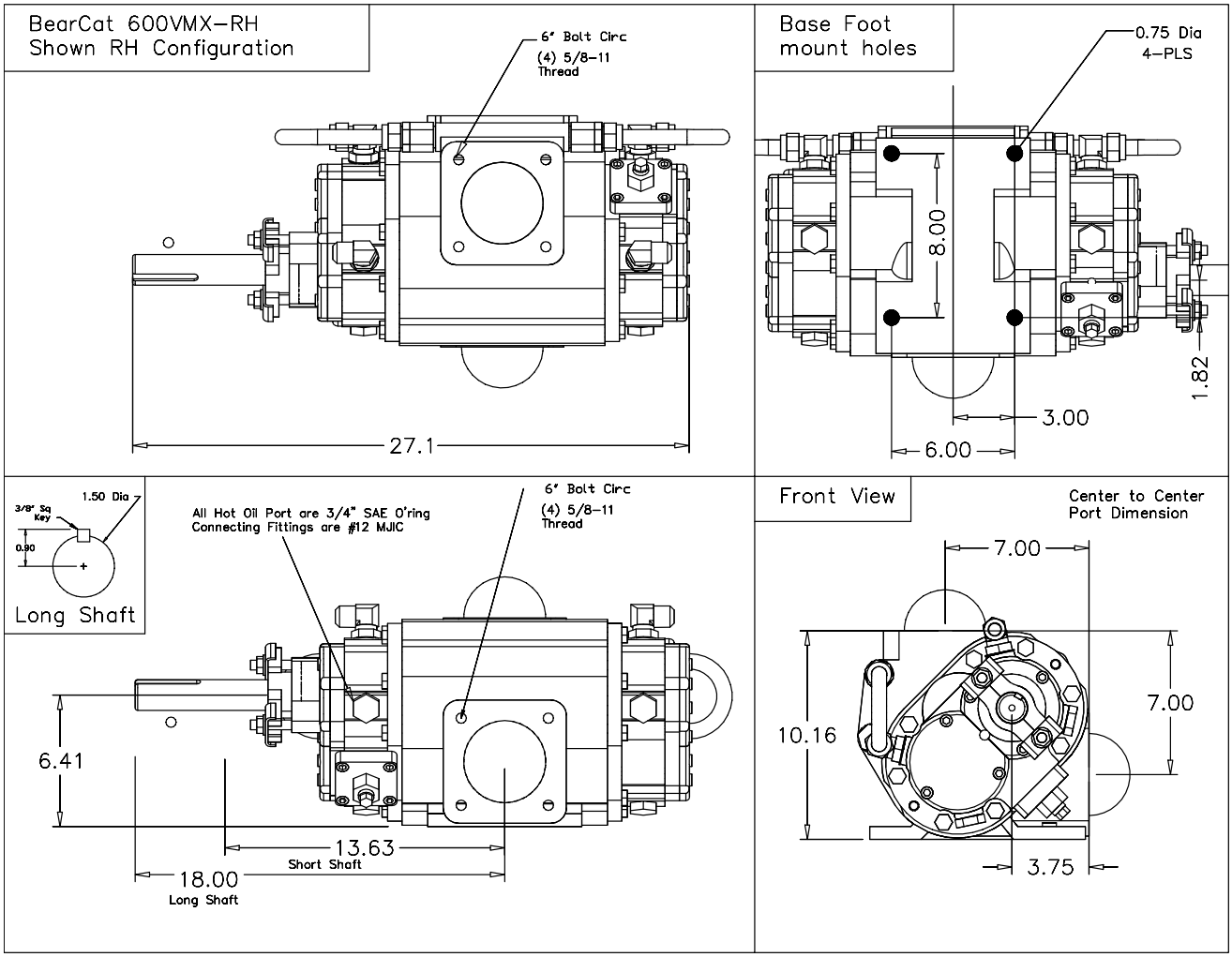
Port Size

- Both ports are a 3" ANSI 150# Pipe flange.
- For high performance requirements, consult factory for weld on flanges for 4" pipe. With this set-up, the pump and entire pipe system are now 4" throughout.

600V & 600B PARTS DIAGRAM / DIMENSIONAL DRAWING



To order specify model number (ex - 600VMX) followed by item; (1) Housing (2) Gear Set (3) End Plate Gasket (4) Idler Shaft (5) Drive Shaft (6) End Plate (7) Adjuster Nut (8) Adjuster Nut O-ring (9) Relief Valve Assembly (10) O-ring RV plate (11) Bearing Cap (12) O-ring Cover Plate (13) Bushing	Modified Seal (14) M24/Housing Assembly (15) Shaft Seal (16) Dust Seal and Mount Bracket	Heat fittings. All tapped ports require a #12 O-ring Fitting. DO NOT USE PIPE THREAD FITTINGS! (20) #12 MB O-ring Plug (21) #12 MB O-ring Straight (22) J-tube (23) #12 MB O-ring Elbow
	Packed Seal (not shown in drawing) (17) 9-Ring Packing Set (18) Packing Gland (2 pc) (19) Studs/Clips/Washers/Nut (2)	Hardware items can be obtained from a local hardware store. (A) 1/4 Key stock 2” Lg (B) 1/2 Dowel pin 1-1/4” Lg (C) 3/8-16x3/4 Socket Head (D) 1/4-20x3/8 Socket Head (E) 3/8-16x1/2 Set Screw



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